Rock Chips
Fall 2006

Alberta Geological Survey

Geohazards Program Overview

On April 1, 2005, the Alberta Geological Survey (AGS) assumed the responsibility for the long-term monitoring of Turtle Mountain, the site of the world-famous 1903 Frank Slide where more than 70 people died. With funding from the Alberta government and the addition of two full-time staff in August 2005, the Geohazards Program was created. During the first half year of the program, the focus was on the maintenance and upgrading of the Turtle Mountain monitoring system. During that time contacts were made with provincial and federal government agencies, as well as other provincial stakeholders, to establish priorities for the Geohazards Program at the AGS. Based on their input, the following objectives were identified:

- Characterize the geology of Alberta to assist others to recognize, quantify, manage and mitigate naturally occurring physical and chemical geological hazards in Alberta.
- Support and participate in geohazards research in Alberta.
- Engage in the development and application of remote sensing methods to characterize and monitor geohazards.
- Be the hub for geohazards information and outreach materials for the Alberta public and government agencies (provincial and municipal).
- Operate, maintain and upgrade the monitoring system on Turtle Mountain while facilitating research activities using the mountain monitoring system.
- Participate in the development of risk reduction strategies for geohazards in Alberta with an emphasis on the energy sector.

In September 2005, as part of the upgrading and maintenance of the Turtle Mountain monitoring system, a helicopter pad was built on top of Turtle Mountain.

During the summer 2006 field season, visits to the mountain were made by researchers from Simon Fraser University (SFU) and the Aknes/Tafjord Monitoring Project Team from Norway. The SFU group used ground-based LIDAR (Light Detection and Ranging) technology to map portions of the mountain to generate a very fine resolution model of the structural features. The Norway group learned about the technologies being used on site and gained experience from AGS on the development of an early warning system, which may be applied to two large rock slide areas on the fjords of western Norway. The Aknes/Tafjord Project is led by the Community of Stranda in Western Norway with technical guidance from the Norwegian Geological Survey.

1. Turtle Mountain Field Laboratory

The primary function of the Turtle Mountain monitoring system is to provide early warning of a catastrophic rock avalanche. AGS is also facilitating world-class research on the mechanics of slowly moving rock masses to foster advances in instrumentation, and to apply new techniques to characterize the surface and subsurface geology of the mountain. Research will be facilitated by providing access to the mountain, funding of research studies and providing in-kind support and resources (data and personnel) to research organizations throughout the world. Furthermore the AGS will give

researchers access to the near real-time data stream from the network of sensors on the South Peak of Turtle Mountain.

Gordon Jean from the Alberta Geological Survey demonstrates the data acquisition unit enclosure on the weather station at the top of Turtle Mountain. The town of Blairmore is in the distance.

Francisco Moreno of the Alberta Geological Survey explains the function of the tilt meter installed on the mountain to a group from the Geological Survey of Norway. They are in the process of installing a similar monitoring system for a project in the town of Aknes, Norway.

Rock Chips is published four times a year by the Alberta Geological Survey in the spring, summer, fall and winter.

Past and present issues of *Rock Chips* may be viewed on the AGS website located at www.ags.gov.ab.ca.

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If you are currently receiving the paper edition and have a change of name or address, please forward corrections to one of the contacts above.

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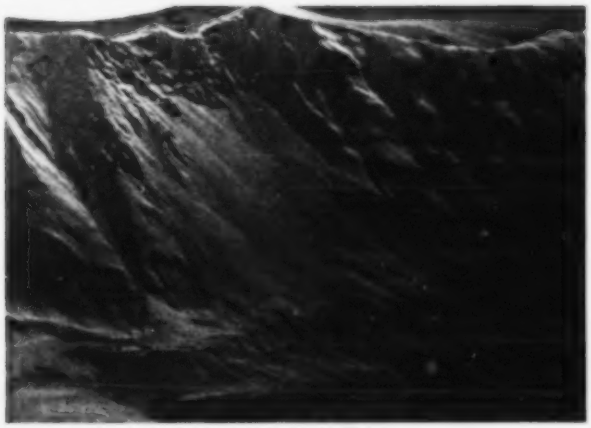
Tel: (780) 297-8242

The research group from Norway examines some of the crack meters located on Turtle Mountain.

Members of a research team from Simon Fraser University positioned on the north peak to do laser scanning of the south peak. Information from the scans is used to create detailed 3-D models of the mountain (see images below).

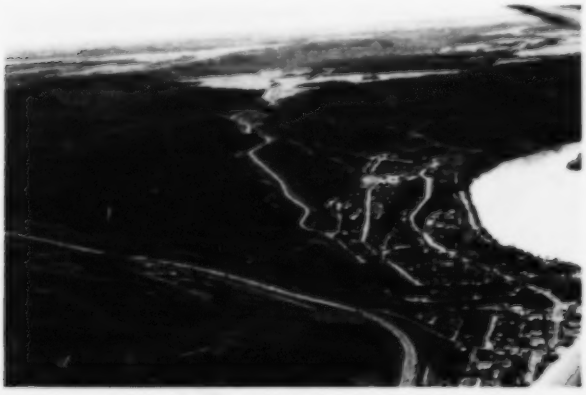
Gordon Jean surveying locations using GPS technology.



3-D digital elevation models (DEMs) of Turtle Mountain. These models make it possible to identify structural features (main joint set, landslide scarps, etc.) and the most likely failure mechanism that may have been involved during the Frank Slide, as well as potential failure modes at the South Peak of Turtle Mountain.

2. Peace River Landslide Project

In addition to work with Emergency Management Alberta to provide expertise at the Turtle Mountain site, another focus of the Geohazards Program is to update our knowledge of geological hazards in selected urban areas. The town of Peace River was chosen as the pilot study area primarily because of a significant number of historical issues with landslides that have impacted residential areas, municipal infrastructure, and transportation networks in and around the town. A three-year study has been developed to characterize the extent, rate and contributing factors for landslides in the area. A stakeholder group with interests in the municipality has been identified and asked to participate in the project. Along with the stakeholders, invited research groups include the Centre for Risk Assessment for Geohazards (CRAGS) at the University of Alberta and the Geological Survey of Canada. The products of this project will be a 3-D geological model encompassing the area of the municipality, a GIS-accessible database of geotechnical and geological information from the stakeholder's files, a satellite InSAR study (see Canadian InSAR Project below) to map historical and current patterns and rates of ground deformation, AGS Earth Sciences Reports and two graduate theses describing the geology, landslide types and mechanisms of failure, and the use of surface geophysical methods to delineate landslides.



Aerial view of the town of Peace River.

3. The Canadian InSAR Project

The use of satellite-based interferometric synthetic aperture radar (InSAR) to detect and characterize landslide hazards is in its early stages in North America. This technique uses satellites, approximately 800 km in orbit, to define zones of ground movement (heave, subsidence, landslides) with subcentimetre or in some cases, millimetre, resolution by collecting accurate distance measurements between the satellite and the ground on repeat satellite orbits at different times.

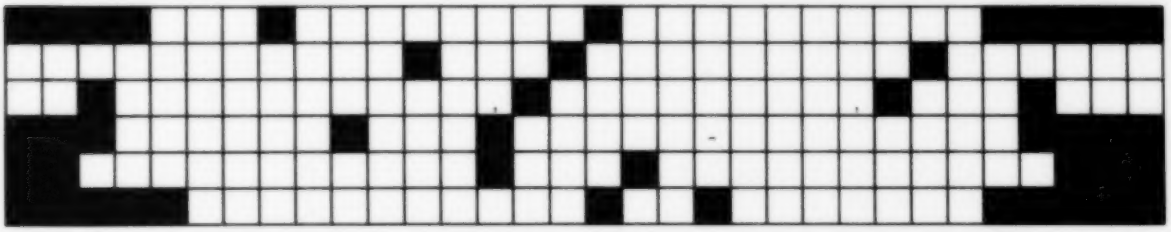
InSAR is considered an important technology not yet commonly used in geohazards practice. The AGS intends to test the technology on strategic sites in Alberta as part of a larger national initiative being led by the Canadian Centre for Remote Sensing (CCRS), with funding support by the Canadian Space Agency (CSA). The CSA-funded project has the specific purpose of developing centres of expertise within government for the application of InSAR for ground hazards. The three national centres are CCRS (Ottawa), GSC (Vancouver) and, most recently, AGS (Edmonton). Over the next three years, each of these centres will focus on regional sites, sharing learnings and cross-training personnel. At the end of the project there will be a clearer understanding of the applications and limitations of the technology, and more importantly, a network of expertise will be established across Canada. Within Alberta, the three sites selected are Turtle Mountain, the Town of Peace River and the Little Smoky Landslide near Valleyview. ❖

Image showing the results of an InSAR deformation survey, completed by Vexcel Canada, overlain on a digital elevation model of Turtle Mountain.

Geological Puzzle

The Alberta Geological Survey Mission Statement

Find the hidden phrase by using the letters directly below each of the blank squares. Each letter is used once.



G S e h p e A r y e
A w a v d m f o t e i x s t t s o e t a
o r b e i p l n n m e t n i n s s t a i n c c e
p u v a r n r e v r n d s e g p o r l b e n a n e
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b n s t e d e t c o o p i d a a r t h e s e i e r a n d e d h e

Great Outreach and Teacher Resources Available at AGS

AGS has four outreach maps that are great learning tools. Two satellite maps, one each showing the cities of Calgary and Edmonton, as well as a geological and topographic map of Alberta. These maps are full-scale for printing on a plotter and are free for download from http://www.ags.gov.ab.ca/activities/outreach/outreach.shtml.

If the files are too large for you to download, you may purchase a CD (EUB/AGS INF 134) with all four maps from our Information Sales office for $5.00.

Alberta Geology Map
(23 MB PDF)
Scale 1:936 745

Alberta Topography Map
(91 MB PDF)
Scale 1:857 119

Calgary Satellite Map
(62 MB PDF)
Scale 1:38 208

Edmonton Satellite Map
(61 MB PDF)
Scale 1:32 458

Have a Listen to Our New Podcasts

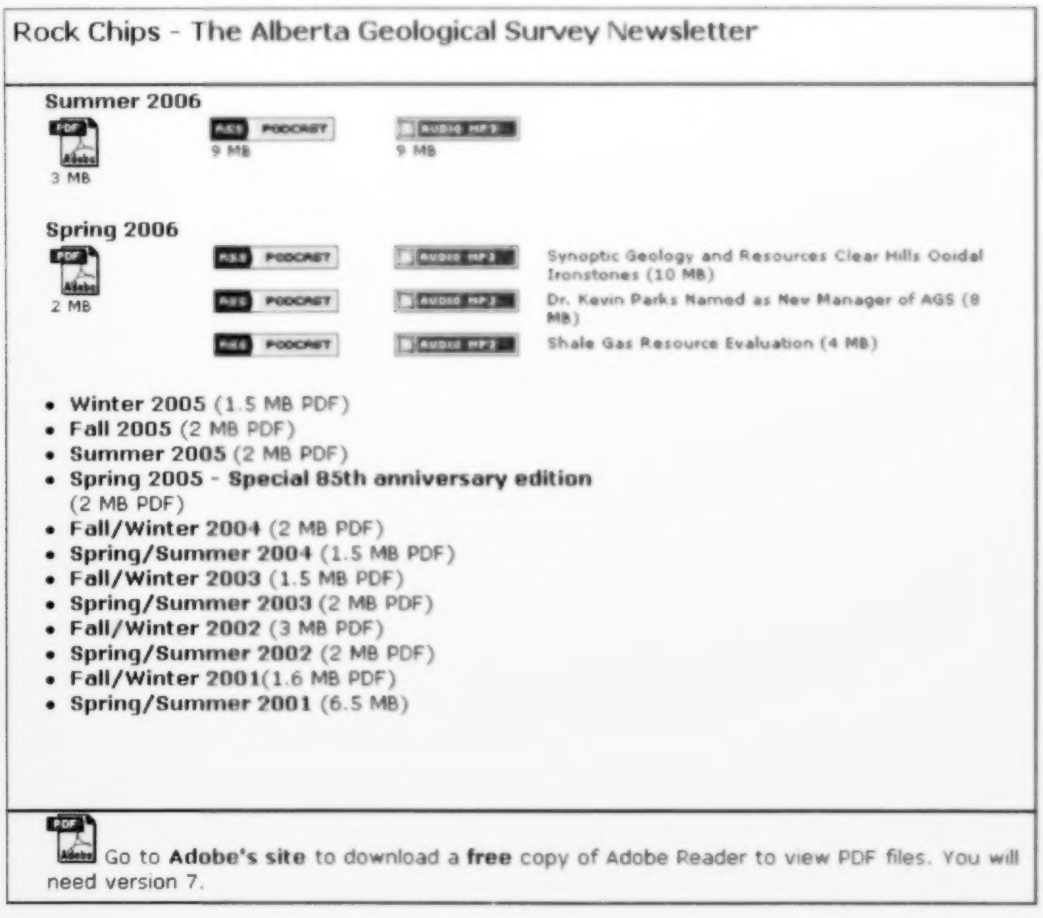
No time to read Rock Chips or attend our speaker series that occur throughout the year? Well we have the solution — podcasts! Rock Chips is now produced as a podcast so you can hear the latest news about the Alberta Geological Survey as you ride to work, jog, walk the dog, etc.

> Podcast: A digital recording of a radio broadcast or similar program, made available on the Internet for downloading to a personal audio player. *(The New Oxford American Dictionary)*

Not only is 'podcast' The New Oxford American Dictionary editors' pick for Word of the Year in 2005, it is now a new item on the AGS Internet site. The new podcast link may be found on our publications web page at

http://www.ags.gov.ab.ca/publications

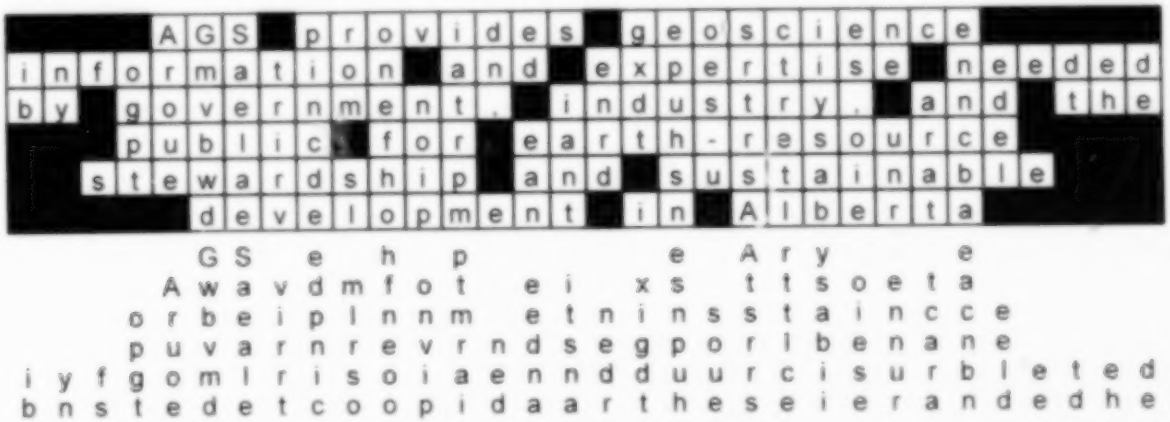
Currently links are only available for the 2006 spring and summer editions of Rock Chips, but there will be additional podcasts added of upcoming and past issues. There are two icons, one that links directly to the .mp3 file and the other to a RSS feed that you can put into your audio player to subscribe to our podcasts and listen at a later time. ❖



Geological Puzzle Solution

The Alberta Geological Survey Mission Statement

Find the hidden phrase by using the letters directly below each of the blank squares. Each letter is used once.



Recently Released Publications

Digital Datasets

DIG 2006-0042 Locations Where Gas was Noted Extracted from Alberta Environments Groundwater Database (2002).

Earth Sciences Reports

ESR 2006-02 Geological Reconnaissance Work in the Andrew Lake Area of Northeastern Alberta, NTS 74M. 67 MB PDF. $20.00

Geo-Notes

GEO 2006-01 Petrography and Geochronology of Crustal Xenoliths from Northern Alberta Kimberlite. 3.5 MB PDF. $20.00

Special Reports

SPE 079 Seismic Investigation of Selected Kimberlite Pipes in the Buffalo Head Hills Kimberlite Field, North-Central Alberta, (poster). 2.5 MB PDF. $20.00

Story Contact Information

The following AGS staff may be contacted for further information on their articles or citations.

Geohazards Program Overview	Corey Froese	(780) 427-2872
Check Out Our New Podcasts	Maryanne Protz	(780) 427-2890

Staff may also be contacted via e-mail by entering the author's first name.last name@gov.ab.ca

Comments and suggestions for Rock Chips may be sent to Maryanne Protz at maryanne.protz@gov.ab.ca

Conferences Involving Alberta Geological Survey

CSPG Honourary Address
Jubilee Auditorium
Calgary, Alberta
October 24, 2006

Unconventional Gas Conference
Telus Convention Centre
Calgary, Alberta
November 15 - 17, 2006

Check Out this Web Page (Base of Groundwater Protection)

Click image to enlarge.

As of April 4, 2005, this task has been taken over by the Alberta Geological Survey (AGS) of the Alberta Energy and Utilities Board. Oil and gas industry requests should now be forwarded to AGS.

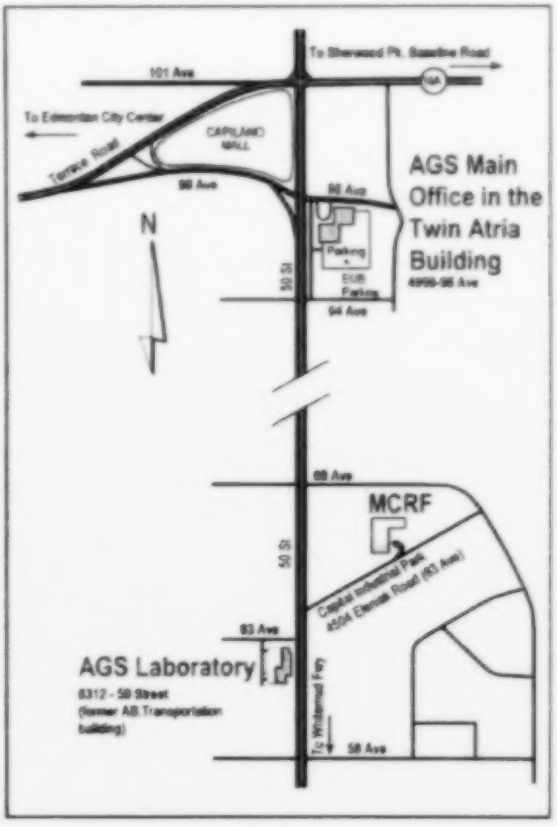
Alberta Environment defines an aquifer containing usable groundwater as any strata capable of producing water with a total dissolved solids content of less than 4,000 mg/L. Strata may be sandstones, siltstones, coals or fractured shales. The EUB provides information on the depth of usable groundwater, otherwise known as the Base of Groundwater Protection, to the oil and gas industry through its publication **ST-55: Alberta's Usable Groundwater Base of Groundwater Protection Information**, released in June 1995.

For almost every township in the province, one of the following types of datum exists in the database:

1. Reference well information
2. Township depth information
3. Formation information

Where no data exist, there were insufficient data or minimal data available at time of publication to determine an appropriate Base of Groundwater Protection value or formation.

http://www.ags.gov.ab.ca/activities/Groundwater/base_groundwater_protection.html



AGS Locations

The main office of the Alberta Geological Survey is located at

4th Floor, Twin Atria Building
4999 - 98th Avenue
Edmonton, Alberta
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Tel: (780) 422-1927
(780) 422-3767 Information Sales
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Tel: (780) 427-4663
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Our Mineral Core Research Facility (MCRF) is located at

4504 Eleniak Road
Edmonton, Alberta

For information on the MCRF or to book a visit, contact Dan Magee by phone at (780) 427-4195 or by e-mail at Dan.Magee@gov.ab.ca